EED2303 Logic Design

Final Report

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Abstract

The purpose of this report is to explain how logic gates work and what they do. Different setups were created for these five logic gates to operate, and their functioning was documented. Ultimately, it was determined that each of these gates is distinct, and their modes of operation have been thoroughly investigated. In future work, their functioning will be understood, and actions will be taken accordingly.

Theory

In theory, we expected the values in the truth tables of the integrated circuits to be the same. In the experiment, we saw that this was indeed the case.

Logic Gates

0.0.1 NOT Gate

A NOT gate, also called an inverter, is a basic digital logic gate. It has one input and one output. The NOT gate reverses the input signal:
-If the input is 1 (HIGH), the output is 0 (LOW).
-If the input is 0 (LOW), the output is 1 (HIGH).

Input A	Output
0	1
1	0

The symbol of the NOT gate is a triangle with a small circle at the output.

0.0.2 AND Gate

An AND gate is a basic digital logic gate. It has two or more inputs and one output.
-The AND gate only outputs 1 (HIGH) if all its inputs are 1. If any input is 0 (LOW), the output is 0.
Truth Table (for two inputs):**

Input A	Input B	Output
0	0	0
0	1	0
1	0	0
1	1	1

OR Gate

An OR gate is a basic digital logic gate. It has two or more inputs and one output.
-The OR gate outputs 1 (HIGH) if at least one of its inputs is 1. If all inputs are 0 (LOW), the output is 0.
Truth Table (for two inputs):

Input A	Input B	Output
0	0	0
0	1	1
1	0	1
1	1	1

NAND Gate

A NAND gate is a basic digital logic gate. Its name stands for NOT AND, which means it is an AND gate followed by a NOT gate.
The NAND gate has two or more inputs and one output.
-The output is 0 (LOW) only if all inputs are 1 (HIGH).
-Otherwise, the output is 1 (HIGH).
Truth Table (for two inputs):

Input A	Input B	Output
0	0	1
0	1	1
1	0	1
1	1	0

NOR Gate

A NOR gate is a basic digital logic gate. Its name stands for NOT OR, which means it is an OR gate followed by a NOT gate. The NOR gate has two or more inputs and one output.
-The output is 1 (HIGH) only if all inputs are 0 (LOW).
-If any input is 1 (HIGH), the output is 0 (LOW).
Truth Table (for two inputs):

Input A	Input B	Output
0	0	1
0	1	0
1	0	0
1	1	0

APPLICATION & RESULTS

For NOT Gate

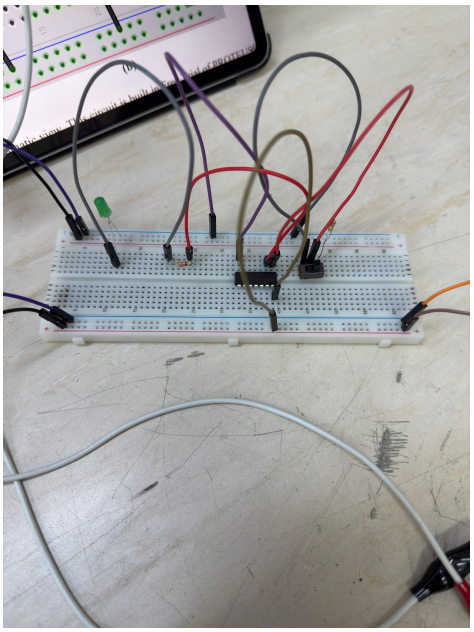


Figure 1: Statement of OFF

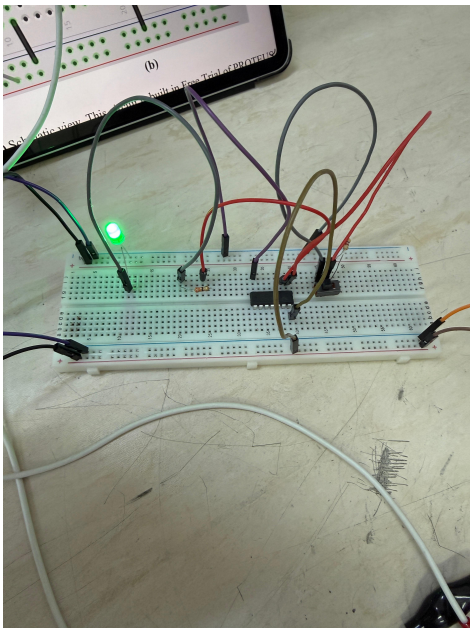
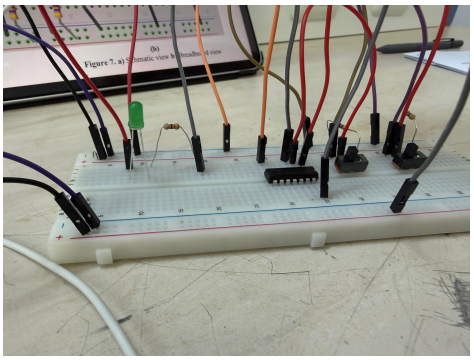


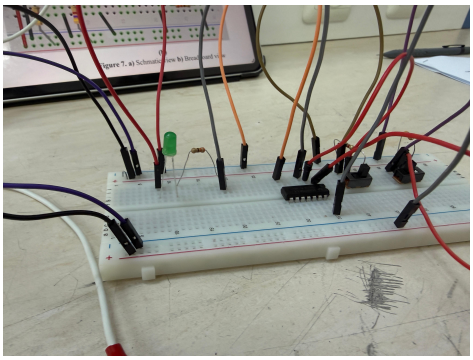
Figure 2: Statement of ON

The LED was observed to light up when the output was high (because the current passed through +V).
-The LED did not light up when the output was low (because the output was pulled to ground and there was no potential difference).
-Therefore, the LED lit up when the NOT gate's output was high, but did not light up when the input was high because the output was low.

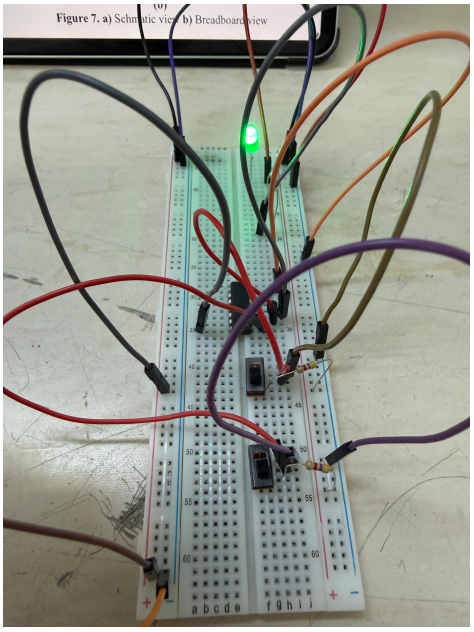
For AND Gate



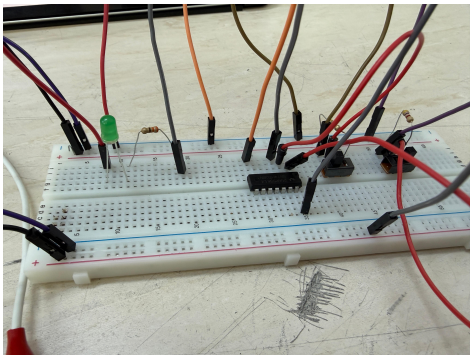
(a) Statement of 0-0



(b) Statement of 1-0



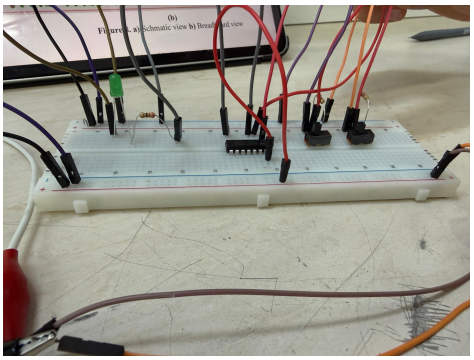
(c) Statement of 1-1



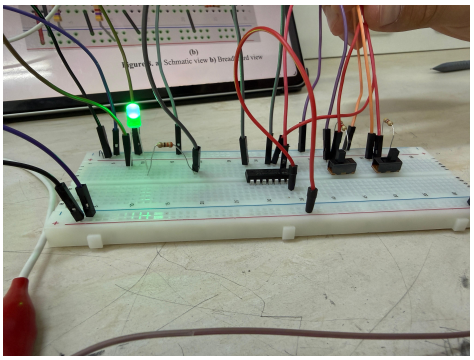
(d) Statement of 0-1

-We connected both switches in series.
-We observed that the current only flowed when both switches were closed.
-Finally, we observed that the LED lit up

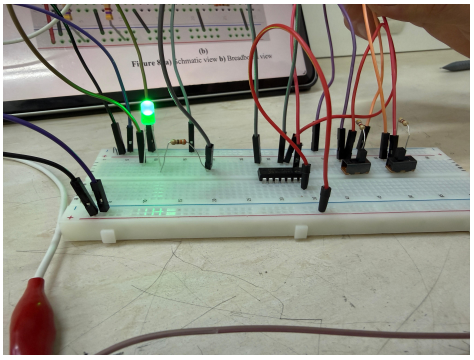
For OR Gate



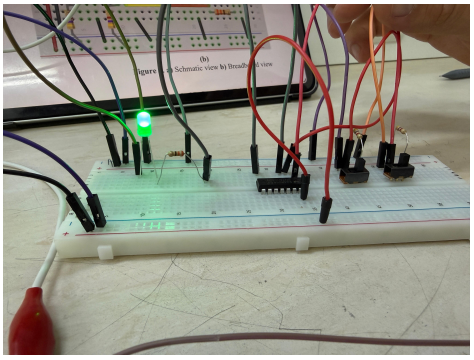
(a) Statement of 0-0



(b) Statement of 0-1



(c) Statement of 1-0



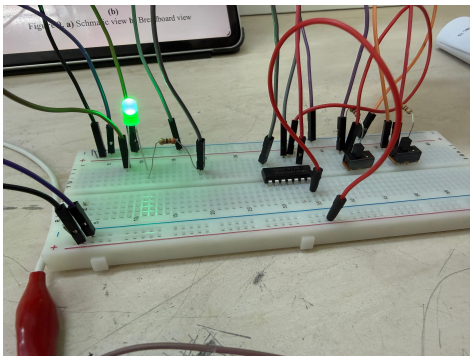
(d) Statement of 1-1

-We connected the two switches in parallel.

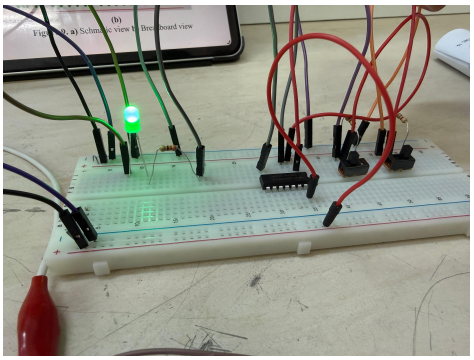
-We thought that in a parallel connection, current would flow as long as at least one switch was closed.

-In the end, we observed that the LED lit up.

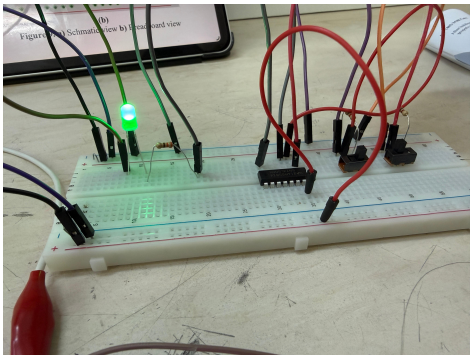
For NAND Gate



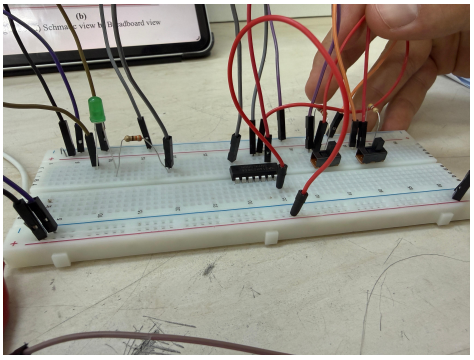
(a) Statement of 0-0



(b) Statement of 0-1



(c) Statement of 1-0

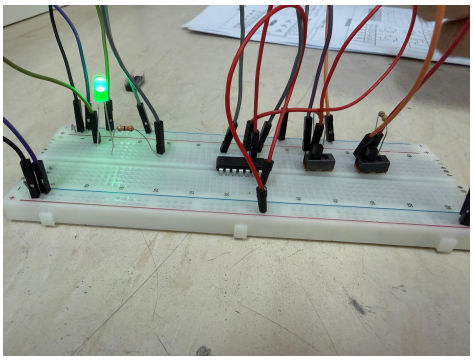


(d) Statement of 1-1

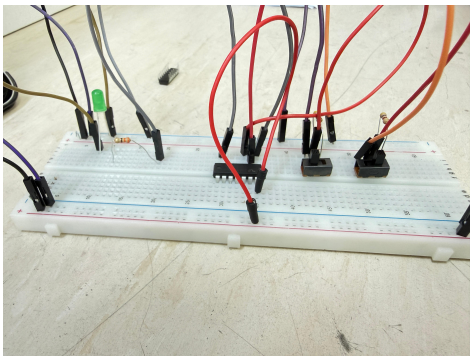
Two switches were connected in series.
-We assumed that current would only flow if both switches were closed.
LED status:
-We observed that the LED did not light up when both switches were closed.
-We observed that the LED lit up in other cases.

We connected the two switches in parallel.
We assumed that current would flow when at least one switch was closed.
LED status:
We observed that the LED lit up when at least one switch was closed.
We observed that the LED was off when both switches were open.

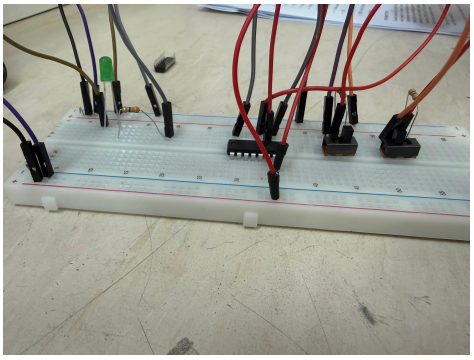
For NOR Gate



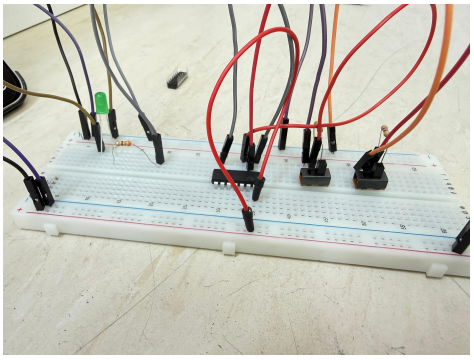
(a) Statement of 0-0



(b) Statement of 0-1



(c) Statement of 1-0



(d) Statement of 1-1

Connection type: We connected the two switches in parallel.
Parallel connection logic: We thought that current would flow if at least one switch was closed.
LED observation: In the end, we observed that the LED did not light up.

CONCLUSION

As a result, we saw that all the doors worked correctly and gained an understanding of how they function. We observed that some doors exhibited opposite behaviors. We also observed that these integrated circuits cannot handle values exceeding 5V. Finally, I would like to emphasize that exceeding 5V can result in permanent damage.